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I, KIM MARSHALL, MANAGER EXAMINATION SUPPORT AND SALES, hereby certify that the annexed is a true copy of the Provisional specification in connection with Application No. PM 9218 for a patent by MEDICAL PLASTICS (AUST) PTY LTD filed on 4 November 1994.

WITNESS my hand this Thirteenth day of November 1998

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Regulation 3.2

COMMONWEALTH OF AUSTRALIA
Patents Act 1990

PROVISIONAL SPECIFICATION FOR THE INVENTION ENTITLED :

FILTERING APPARATUS

This invention is described in the following statement :-

This invention relates to filtering apparatus which has particular but not exclusive application to filtering water from swimming or spa pools.

Filtering apparatus is commonly used in swimming and spa pools for filtering the water in such pools. The apparatus which is in use is in a number of different forms ranging from cartridge type filters to sand and diatomaceous earth filters. Each type of filter is required to be regularly cleaned to maintain the efficiency of the filtering operation and also to ensure that excessive pressure loadings are not applied to the circulating pump. In the case of cartridge type filters, the filter is required to be disassembled, the filter cartridge removed and cleaned before reassembly. In the case of sand or diatomaceous earth filters, cleaning is accomplished by backwashing, that is causing the flow of water to pass in a reverse direction through the filter. Often backwashing is only carried out when the filter is substantially blocked and is normally achieved manually by operation of a valve. Usually also, these filters are required to be disassembled at regular intervals and recharged with sand or diatomaceous earth. The cleaning procedures described above are tedious and time consuming. Additionally, if these filters are not regularly cleaned, the efficiency of filtering is substantially reduced which for example reduces the efficiency of vacuum pool cleaners.

The present invention aims to provide filtering apparatus which reduces or eliminates the need for regular manual cleaning or backwashing. In particular the present invention aims to provide apparatus in which backwashing of the filter occurs automatically in response to sensed conditions of filtering. Other objects and advantages of the invention will become apparent from the following description.

The present invention provides in a preferred aspect, filtering apparatus for filtering liquid, said apparatus including a chamber, a filtering element in said chamber, and valve means for directing liquid through said

filtering element in a first direction for filtering said liquid, said valve means being operable to reverse the direction of liquid flow through said filtering element when excessive resistance to flow through said filtering element occurs. Excessive resistance to flow through the filtering element causes an increase in pressure on the upstream side of the filtering element. The valve means responds directly or indirectly to this increased pressure to reverse the flow of liquid through the filtering element. whereby to backwash said filtering element when backpressure exceeds a predetermined limit.

Preferably the valve means includes valves on opposite sides of the filtering element, the valves being simultaneously opened and closed to reverse the flow of liquid through the filtering element. The valve means suitably also includes a further valve which is opened upon reversing the flow through the filtering element to direct that flow to waste.

In one preferred form, the filtering element is movable to cause said valve means to reverse the flow of liquid therethrough. Movement of the filtering element will occur upon increased pressure as aforesaid.

In the above, the valve means may comprise a first fixed duct having spaced apart ports therein on opposite sides of the filtering element, and a movable valve member coupled to the filtering element so as to be movable therewith to control the opening and closing of the ports. In normal operation, one of the ports is open to direct liquid in a first direction through the filter element and the other port is closed. For backwashing, the one port is closed upon movement of the valve member and the other port is opened to direct liquid in the opposite direction through the filtering element for backwashing.

The filtering element is preferably in the form of a relatively stiff porous membrane. Suitably the filtering element is of opposite arcuate cross-sectional stable attitudes during filtering and backwashing respectively. Preferably, the filtering element flexes or

flicks between its two stable attitudes. This causes the pores of the filtering element to open when the filtering element moves to the backwash position to enhance cleaning of the element. Cleaning is also enhanced by the flexing of the element to its backwash position.

When the flow of fluid reverses, the filtering element will be cleaned and the flow of fluid will cause through pressure exerted on the filtering element, the valve means to operate to again reverse the flow for normal operation. At the same time, the further valve will close to prevent dumping to waste.

Means are suitably provided for resisting movement of the valve member to its backwashing position. Such means may comprise a biased element or elements adapted to cooperate with the valve member. The bias or the biased element or elements is required to be overcome to enable the valve member to move to its backwash position.

Suitably, means are provide for damping movement of the valve member and limit shock loadings on the valve member.

Preferably also means are provided for varying the time during which backwashing occurs. Such means suitably controls the movement of the valve member back to its normal operating position. Such means may include a chamber, the exhausting of fluid from which can be selectively controlled.

In order that the invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention and wherein :-

Fig. 1 illustrates in sectional view, the filtering apparatus according to the invention in a normal filtering position; and

Fig. 2 illustrates in sectional view, the filtering apparatus of Fig. 1 during backwashing.

Referring to the drawings and firstly to Fig. 1, there is illustrated filtering apparatus 10 according to

the present invention for normally filtering water of a swimming pool or spa but which may be used for filtering other liquids in other applications. The apparatus includes a hollow body 11 comprising an upper part 12 and a lower part 13 each of which have peripheral flanges 14 and 15 which are adapted to cooperate with an annular seal 16 and an annular clamp 17 which releasably and sealingly secures the two body parts 12 and 13 together. The seal 16 suitably is formed of a resilient material such as santoprene and the clap 17 is preferably a metal clamp of the type known in the art.

A discharge chamber 18 is provided at the lower end of the body part 13 and includes an outlet 19 for discharge water. The outlet 19 is normally connected to waste. An annular valve seat 20 is provided at the junction between the body part 13 and chamber 18. Extending coaxially through the discharge chamber 18 and into the body 11 is a fixed tubular inlet duct 21 which is normally connected to receive liquid pumped from a liquid pump (not shown). The duct 21 is closed at its end 22 located within the body 11 and includes upper and lower sets of ports 23 and 24 in its side wall 25.

Located coaxially about the duct 21 is a tubular valve member 26 which is provided with spaced apart openings 27 and 28 in its side wall 29. O-ring seals (not shown) may be provided between the sidewall 29 of the valve member 26 and side wall 25 of the duct 21 on opposite sides of the openings 23 and 24 and posts 27 and 28. The lower end of the valve member 26 is provided with an outwardly directed flange 30 whilst the upper end is provided with a tubular extension 31 having an outer frustoconical surface 32 the purpose of which will hereinafter become apparent. The upper end of the member 26 is also provided with an end wall 33 which is centrally apertured at 34 to permit a choke screw 35 threadably attached to the upper end of the duct 21 to pass therethrough. The screw 35 has an enlarged head 36 which is of a slightly greater diameter than the diameter of the aperture 34 and which may have an

outer tapering surface. A damping chamber 37 is defined between the wall 33 and the closed end 22 of the duct 21.

An annular valve member 38 is located coaxially about the lower end of the valve member 26. The member 38 includes an lower annular wall 39 which normally seats on the valve seat 20 and an upper annular wall 40 spaced from the wall 39 and extending inwardly to the member 26 so as to allow relative movement therebetween but being substantially sealed thereto.

The upper housing part 12 is provided with a central outlet duct 42 aligned with the inlet duct 21 and valve member 26. A plurality of fingers 43 are pivotally mounted at 44 to the upper end of the housing part 12 and arranged coaxially with the duct 42. An annular biasing member 45 such as a spring or O-ring is provided about the fingers 43 to normally bias the fingers 40 inwardly. The fingers 40 are tapered at their free ends to define inner inclined ramp surfaces 46.

A filtering membrane 47 is connected between the seal 16 and valve member 26 and for this purpose is provided with an inner ring 48 located in a recess or channel 49 in the valve member 26 or connected to the seal 16. The membrane 47 suitably comprises a relatively stiff porous material being of arcuate form in cross section. The membrane 47 divides the body 11 into upper and lower chambers 50 and 51 respectively. In Fig. 1, the membrane 47 is in a stable state but may flick or flex to an opposite stable arcuate state.

In normal operation as shown in Fig. 1, liquid passes into the duct 21, through the ports 24 and aligned openings 28 in the valve member 26 and through the membrane 47 for filtering before it passes out of the outlet duct 42 as indicated by the arrows. At the same time, the openings 27 are blocked by the duct 21 and the valve member 38 is seated on the valve seat 20. Where debris and other materials collect on the filter membrane 47 and start to limit the flow of liquid therethrough, pressure will increase in the chamber 51. This will cause the valve

member 26 to lift upwardly under the influence of the force on the membrane 47. The annular surface 32 on the end of the valve member 26 will thus engage the surfaces 46 on the fingers 43 and the co-operation therebetween will cause the fingers 43 to be pivoted outwardly against the bias of the biasing member 45.

When the force of the biasing member 45 is overcome, the valve member 26 will rapidly move to the position of Fig. 2 where the tubular extension 32 of the valve member 26 surrounds and closes the outlet duct 42 to prevent water flow therethrough. Movement of the valve member to this position, however, is damped through co-operation between the head 36 of the screw 35 and the opening 34. The small clearance between the head 36 and opening 34 will limit flow into the chamber 37 as it expands and thus have a dampening effect on movement of the valve member 26. In this position, the valve member 26 has move sufficiently to cause through the engagement between the flange 30 on the valve member 26 and wall 40, the valve 38 to lift upwardly to raise the annular member 39 from the seat 20. Additionally, the openings 28 will be blocked whilst the openings 27 will be moved into alignment with the ports 23. The liquid flowing through the inlet duct 21 will thus be redirected to pass through the ports 23 and openings 27 into the chamber 50. This will cause the filter member 47 to rapidly move or flex to an opposite arcuate attitude as shown in Fig. 2 causing the membrane pores to open and debris therein to be flushed therefrom into the chamber 51. The filter membrane 47 is thus backwashed into the chamber 51 with backwash water flowing past the valve seat 20 into the discharge chamber 18 for discharge through the duct 19.

Water will only flow through the element 47 for a short period of time and will cause through the force exerted by the membrane 47 on the valve member 26, the valve member 26 to move towards the position of Fig. 1. The period of backwashing can be adjusted by screwing the screw 35 in or out to reposition the head 36 of the screw.

Furthermore, as the valve 26 moves towards the Fig. 1 position, the chamber 37 will be reduced in size and water therein past out between the screw head 36 and aperture 34. This restricted flow of water will again damp the movement of the valve member 26 until the head 36 clears the opening 34. The valve member 38, during this movement will also reseat on the valve seat 20 to cut off the flow to waste.

With the valve 26, again in the position of Fig. 1, flow into the chamber 51 will cause the element 47 to flick back to its opposite position as illustrated for normal filtering.

Because of the flexing action of the filtering membrane 47 as described, only a small quantity of water is required for backwashing. The filtering apparatus 10 will function more efficiently than a normal filter which is usually only backwashed when the filtering membrane or elements are substantially blocked. The filtering apparatus of the present invention will thus allow for greater performance from vacuum pool cleaners, less power consumption and shorter running time. The apparatus 10 may be fitted directly to the top of a pump which results in space saving, particularly in smaller housing blocks, flats and units.

Many variations may be made to the invention without departing from the broad scope and ambit thereof. For example, the valve member 26 may be weighted to provide momentum to move it between its respective positions. The inlet pressure at the duct 21 may also be controlled by a regulator if necessary. The use of the choke screw 35 may not be required in some circumstances and means other than the fingers 43 may be provided for opposing initial movement of the valve member 26.

The valve mechanism for use with the apparatus may also be substantially varied from that shown. For example, in one form the valves defined between the openings 28 and port 24 and openings 23 and port 27 may be replaced by solenoid valves as may the valve arrangement define between the valve member 38 and seat 20. In this

form, one solenoid valve may be provided to control flow through the outlet 42, whilst the other solenoid valve controls flow to the chamber 51 and through the membrane 47 as well as the discharge to waste for backwashing. A pressure sensor switch located in the chamber 51, upon sensing excess pressure will cause operation of the solenoid valves to prevent water flow through the outlet and cause a reversal of flow through the filtering membrane 47 and open the chamber 51 to waste or discharge for backwashing purposes. This may be done for a set period of time, after which the valves may again be reversed to permit flow through the outlet, close the waste valve and direct the flow in the normal direction through the membrane 47.

The membrane 47 in this embodiment may be in a similar form to that described with reference to the drawings except that in this instance it would be fixed at its inner periphery.

The membrane 47, of course may be of many different forms and need not necessarily flex between the opposite arcuate attitudes shown. The membrane in the form of Fig. 1, however, may be stiffened on either side by scrim.

The main components of the embodiment of Figs. 1 and 2 are preferably formed of plastics by injection moulding.

Whilst the above has been given by way of illustrative embodiment of the invention, all such modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as herein set forth.

DATED this fourth day of November 1994

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By Our Patent Attorney

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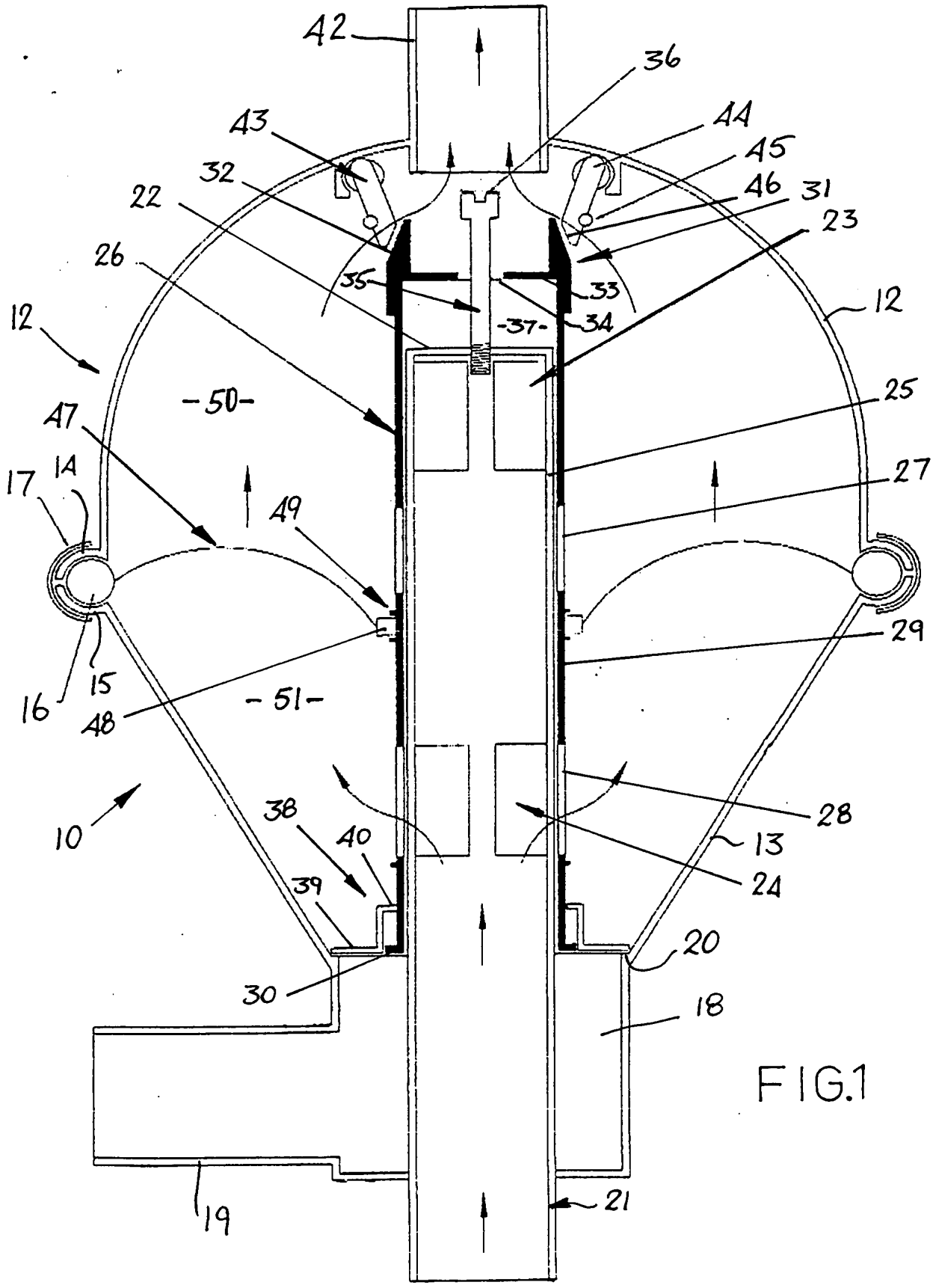
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FIG.1

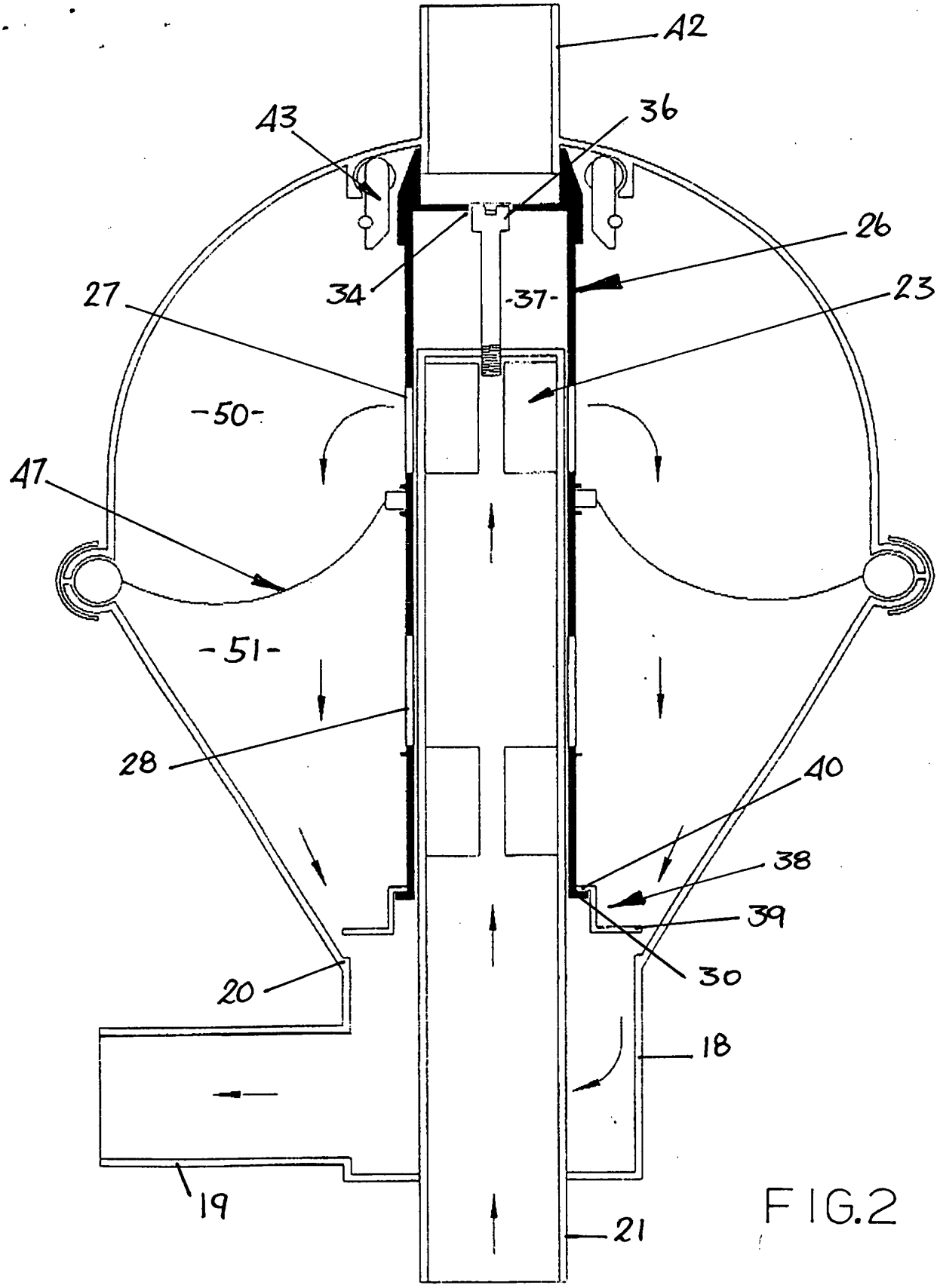

FIG.2